Return to Part 1

GOAL 2: Assess the status and trends of ecosystems and natural resources and their uses

KEY FINDINGS

- *Species most susceptible to sudden oak death were thriving prior to disease introduction.*
- *Palau's forests are maturing but urbanization and conversion to nonforest uses have led to decreases in forest area.*
- *Population growth and associated residential development in counties with national forests and grasslands put pressure on the resources of these public lands.*
- *National timber assessment indicates increases in U.S. demand for timber will be met by increased harvests on private land and through imports.*
- *Timber statistics reveal younger forests with fewer trees per acre are growing in eastern Washington on private land and public land not administered by the Forest Service.*
- *New tree height models for west coast forests improve accuracy of inventory data and reduce cost of data collection.*
- *Updated FUSION software lets users more easily process LIDAR forest vegetation data, and expanded tutorials are now available online.*

Left: Mount Bachelor and Todd Lake, Oregon. Photo by Tom Iraci.
Above: Ponderosa pines on the Ochoco National Forest, Oregon. Photo by John Hutmacher.

Historical data reveal long-term effects of wildfire on watershed processes

Wildfire affects water quantity and quality in a watershed. These effects may be long-lasting and depend, in part, on rehabilitation actions that occur after the fire. In this study, scientists used rare historical data from the Entiat Experimental Forest to create models to evaluate the effects of a severe 1970 wildfire on streams draining forested headwaters. Preliminary results indicate that runoff from the burned area more than doubled. These increases in peak flows resulted from less vegetation present to draw groundwater, greater snow accumulation, and more rapid snowmelt.

Richard Woodsmith

A study established in 1970 after a wildfire on the Entiat Experimental Forest enabled scientists to study long-term effects of fire on watershed processes. Here a field technician checks a flume that measures runoff from the area burned in 1970.

After more than 25 years of inactivity, the study watersheds were reinstrumented in 2004 with stream gauging, water quality, and meteorological stations to assess the rate of recovery toward prefire conditions. This data will also be used in future investigations of the effects of prescribed burning and other fuel control treatments on hydrologic processes.

The information gained from this research will enable scientists and managers to better predict the effects of severe wildfire on hydrology and to better understand the hydrologic recovery process after major disturbances. It will also inform management decisions regarding the need and strategies for postfire rehabilitation.

Contact: Richard D. Woodsmith, rwoodsmith@fs.fed.us, Aquatic and Land Interactions Program

Partners: Oregon State University, USDA Forest Service Okanogan-Wenatchee National Forest

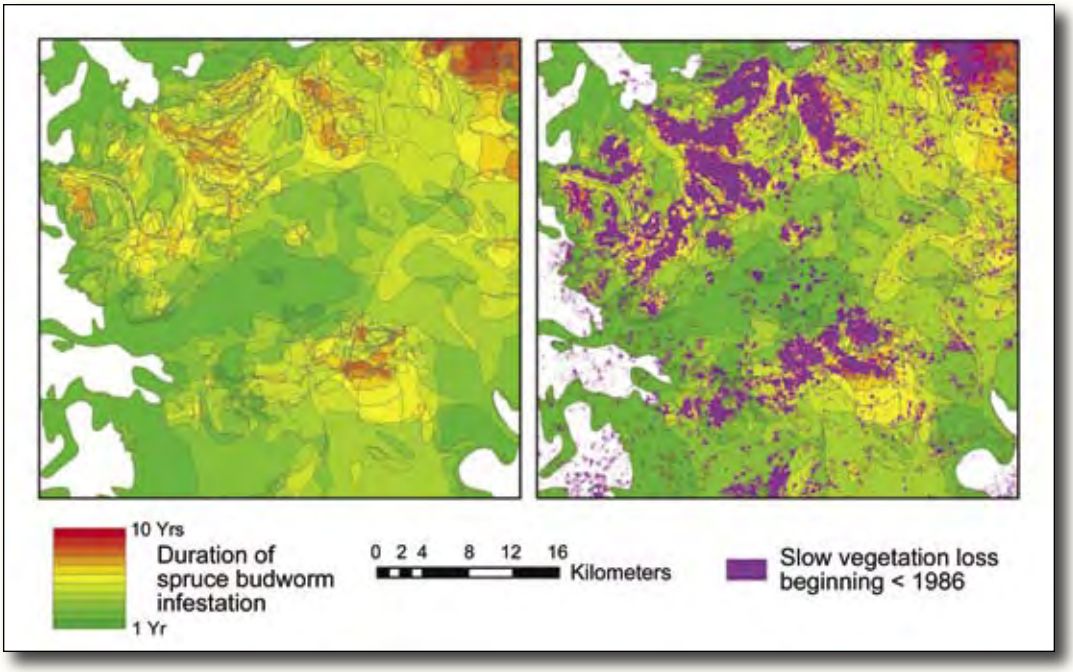
New satellite-based mapping technique captures full range of forest disturbance and recovery across landscapes

Satellite-based maps help researchers and land managers visualize forests and landscapes across the Pacific Northwest. Until recently, satellite-based maps of forest disturbance have only been able to capture major, stand-replacing events such as clearcuts and intense fires, not the complete range of forest disturbance and recovery.

To improve the usefulness of satellite-based maps, Station scientists developed and validated a fundamentally new approach to mapping that captures both major events and other disturbances—including partial cuts and thinnings and insect and disease mortality. The new approach also is capable of mapping year of disturbance, intensity of disturbance, and the rate of recovery.

The products derived from this new satellite-based mapping approach are useful to a wider range of research and public constituencies. The approach's ability to map subtle disturbances will allow better understanding of changing forest management practices across private and public lands over the past two decades. Mapping insect mortality can potentially contribute to fire-fuels management and planning efforts. The ability to conduct yearly mapping also allows richer studies of the connections between forests and economies over time.

Contact: Robert E. Kennedy, robertkennedy@fs.fed.us, Ecosystem Processes Program



Advances in satellite mapping capture a greater variety of forest disturbances and rates of recovery.

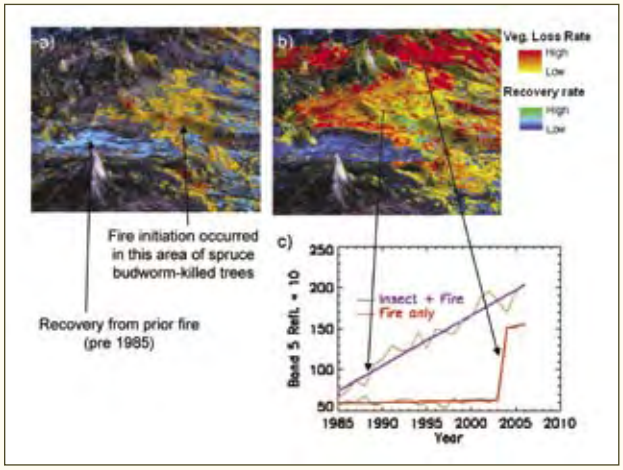
NEW TOOL

MapCurves

Description: The identification of key differences between maps is the basis for much vegetation cover and habitat change-detection study done under the aegis of landscape ecology or climate change research. MapCurves is a new quantitative method for comparing two or more maps; it unambiguously and quantitatively shows the degree of agreement (i.e., spatial concordance) between the maps. MapCurves graphically and quantitatively evaluates the degree of fit among any number of maps and quantifies a goodness-of-fit for each polygon, as well as the entire map.

Outcomes: We live in a world with an ever-shifting climate, and changing patterns of land cover, biogeography, dominant processes, and habitats. Each of these changes may be reflected in maps that people can visually inspect, but they are difficult to compare. MapCurves allows users to compare maps not only visually but also quantitatively. For example, MapCurves is an ideal method for comparing maps derived from remotely sensed or simulated images, using chronological sequences of vegetation cover resulting from succession, disturbance, or climatic change.

How to get it: Journal of Geographical Systems. 8: 187–208, or contact Paul Hessburg, phessburg@fs.fed.us, Managing Disturbance Regimes Program



Tanoak was thriving prior to introduction of sudden oak death pathogen

Sudden oak death in the United States was first observed in California in 1995. Since then, it has spread rapidly through many host species. Several counties in California and one forest site in Oregon are under quarantine, which affects removal of forest products from these areas.

Tara Barrett

Tanoak, a common tree in coast coniferous forests in California, is dying from sudden oak death. To help forest managers contain and control the disease, scientists used historical inventory data to identify forest conditions before the disease was introduced.

Understanding the ramifications of this disease requires a baseline knowledge of the forest conditions before the disease was first observed. Forest inventory data collected between 1981 and 1984 and between 1991 and 1994 from private and public land in California enabled researchers to determine the distribution and abundance of the vulnerable species and to determine the rates of change and mortality prior to the onset of sudden oak death. The study found that host tree species, particularly tanoak, had been increasing in number and size prior to the first observation of the disease.

Inventory information continues to be collected annually on private and public forest land to better understand the impacts of sudden oak death on coastal California ecosystems. By understanding mortality rates prior to the introduction of sudden oak death, forest managers will be better able to determine appropriate forest management activities as they try to control and contain the spread of the disease.

Contact: Tara M. Barrett, tbarrett@fs.fed.us, Forest Inventory and Analysis Program

Partners: USDA Forest Service Forest Health Protection

Palau's forest area declines slightly

The Republic of Palau encompasses a series of islands lying 500 miles southeast of the Philippines. Its tropical forests have endured occasional typhoons; clearing for development, agriculture, and mining; introduced human-caused fires; and significant battles on some islands during World War II. This inventory revealed that since 1985, trees generally are getting larger, but some forest area has been lost to agriculture and urban development. Currently about 2.2 percent of Palau is classified as urban. Further urban development is expected on the island of Badeldaob; the nation's capital was relocated there in 2006, and a new road

Joe Donnegan

Palau coastline.

Left: New growth in tree crown viewed from the canopy crane at Wind River Experimental Forest. Photo by Tom Iraci.

Joe Donnegan

Field crews inventoried Palau's tropical forests.

circumnavigating the island has created access to previously remote areas.

Results from this inventory enable resource managers in Palau to manage for sustainable supplies of wood, control invasive species and erosion, detect and plan for land-use change, and manage disturbances such as fire and animal damage. This inventory also provided an exchange of expertise among local students and foresters, and foresters and ecologists from mainland United States, Guam, Yap, and American Samoa. Multiple clients have asked for this data, including Palau forestry staff, the Natural Resource Conservation Service, university researchers, the Institute for Pacific Islands Forestry, the United Nations Food and Agriculture Organization, the Pacific Southwest Region of the USDA Forest Service, and U.S. Fish and Wildlife Service.

Contact: Joseph A. Donnegan, jdonnegan@fs.fed.us, Forest Inventory and Analysis Program

Partners: Foresters and ecologists of Palau

Outcome: Recent forest inventory enables Palau's resource managers to manage for sustainable wood supplies and healthy forests.

Residential development expected to increase along borders of national forests

The U.S. population is projected to increase by around 135 million people by 2050. Counties with national forests and grasslands are already experiencing some of the greatest population growth and the National Forests on the Edge project indicates that an additional 21 million acres of nearby rural land will likely experience substantial increases in residential development in the coming decades.

People are attracted to the rural areas around public land, in part, by the recreational opportunities provided by these lands. In

Eric White

Proximity to federal land is a selling point for many prospective home buyers.

addition, the country's 155 national forests and 20 grasslands provide clean water, clean air, wildlife habitat, and forest products that support rural economies and urban lifestyles. Monitoring changes in recreation use as a result of an increasing local population provides managers with information that will help them address changes in recreation demands while also managing for other resources.

In coordination with the National Forests on the Edge project, scientists developed monitoring approaches to estimate recreation activity by using readily available Forest Service data. These findings were shared with State and Private Forestry and the National Forest System. The projections of residential development also are being provided as a tool for local and state agencies to use in natural resource planning.

Contact: Ralph Alig, ralig@fs.fed.us, Human and Natural Resources Interactions Program

Partners: Colorado State University; USDA Forest Service National Forest System, State and Private Forestry, Cooperative Forestry, and Washington Office.

Outcome: Local and state agencies are using residential projections in natural resource planning.

Increasing demands for timber will be met by private harvests and imports

The latest assessment of the U.S. timber situation, conducted under the mandate of the Forest and Rangeland Renewable Resource Planning Act (RPA), indicates that the Nation will use 38 percent more timber in 2050 than it does now, and domestic harvests will increase by 24 percent. This increase in demand will likely be met through increased harvests on private land in the South and through increased imports. Canada is currently the largest supplier of timber to the United States, but by 2050 the volume of imported timber from other countries is projected to increase by 23 to 26 percent. Two other possible futures have opposing impacts on consumers. First, reduced pine plantations in the South would lead to higher product prices and increased imports of lumber and other wood products. Second, increased thinning of public lands in the West would reduce imports, lower product prices, and thus reduce market incentives for sustainable forest management on private land.

Andrew Gray

Timber harvests between 1990 and 2001 exceeded growth on nonfederal land in eastern Washington.

This study contributes to the 2005 RPA Timber Assessment Update and the Interim Update of the 2000 Renewable Resource Planning Act Assessment.

Contact: John Mills, jmills@fs.fed.us, Human and Natural Resources Interactions Program

Partners: Oregon State University, USDA Forest Service Forest Inventory and Analysis (all units) and Forest Products Laboratory

Younger, smaller trees characterize non-Forest Service forests in eastern Washington

Timber management has many implications for future timber revenues and nontimber forest resources. A 2001 inventory sampled all private and public land in 20 counties in eastern Washington, except those administered by the Forest Service and those that were reserved from timber management. Timber statistics reveal that in the 11 years between inventories, the area of land producing timber products in eastern Washington has remained relatively

stable, but the volume of available timber per acre has declined. The current timber market does not place a premium on wood quality, so younger trees are being harvested. The intensive forestry practices found on private land in this study contrast with protection management and longer rotations generally found on Forest Service land.

Information on the status and trends of forest resources in Washington is invaluable to land managers, investment bankers, policymakers, and others in evaluating future investments and management options for their lands. Data from this study were included in *The Future of Washington Forests*, a report to the state legislature published by the Washington Department of Natural Resources.

Contact: Andrew Gray, agray01@fs.fed.us, Forest Inventory and Analysis Program

Partner: Washington Department of Natural Resources

Outcome: Findings about Washington's timber resources reported to state legislature.

Scientists assess accuracy of LIDAR measurements

Tree height is a fundamental measurement taken during forest inventory and is used to determine forest biomass, carbon stocks, growth, and site productivity. This measurement is typically time-consuming and, therefore, costly to obtain when using conventional field techniques. The emergence of airborne LIDAR (light detection and ranging) remote sensing has provided an economical and efficient means of obtaining tree heights over large areas of forest. But its accuracy needed to be assessed and compared to alternative field techniques.

Misha Yatskov

New tree height models for California, Oregon, and Washington are used to reduce measurement error. Here a forest technician measures tree heights with a laser.

This study determined optimal LIDAR system settings for acquiring accurate individual tree heights for overstory trees in conifer forest stands of the Pacific Northwest. Scientists also found that LIDAR-obtained height measurements were more accurate for Douglas-fir than for ponderosa pine. The field-based height measurements were slightly more accurate than the LIDAR measurements, but the field measurements were acquired under ideal conditions, in open stands where tree crowns were easily visible.

Contact: Hans-Erik Andersen, handersen@fs.fed.us, Forest Inventory and Analysis Program

Partner: University of Washington

New mathematical models help find efficient inventory methods

Periodic inventories of our Nation's forests are critical for assessing forest health, monitoring management outcomes, and planning for the future. In these inventories, some types of measurements, such as tree heights, can be measured or modeled in different ways. For example, tree heights can be measured in the field, modeled from diameter, or measured with airborne laser scanning systems (see LIDAR finding above). Alternatives for estimating forest attributes typically differ in cost of data collection and accuracy. This study developed a mathematical optimization method for evaluating these types of tradeoffs. Using the example of measuring or modeling tree heights, the research showed how managers can find efficient solutions to the problem of deciding how to collect inventory data.

As part of the example application, new tree height models were developed for west coast forests and have been programmed into the data recorders used by the field crew

Charlie Crisafulli

Field crew sampling the vegetation on the pumice plain at Mount St. Helens.

conducting inventories in Washington, Oregon, and California. This has improved the accuracy of inventory data while reducing the time costs involved with data collection and analysis.

Contact: Tara M. Barrett, tbarrett@fs.fed.us, Forest Inventory and Analysis Program

Outcome: Field crew use more efficient and accurate methods for obtaining tree heights.

LIDAR forest vegetation measurement software updated, expanded tutorials now available online

The FUSION system, user-friendly software for processing and displaying airborne laser scanning data has been updated by Station scientists and is being distributed through the USDA Forest Service's Remote Sensing Application Center (RSAC).

The software has been enhanced to ease processing of data for large projects, and several new metrics have been added to help characterize vegetation structure over large land areas. FUSION tutorials, developed by RSAC, provide an online software installation guide and task-specific instruction focused on interactive display and presentation features of FUSION as well as the data processing environment. By using the tutorial and companion sample LIDAR data set, users can learn how to process LIDAR data into ground models and forest canopy height models, measure individual trees, and automate processing tasks for large projects.

The FUSION LIDAR software system has been used for several projects on national forests by researchers at several universities and by other federal, state, and private groups to display and analyze forest vegetation.

Contact: Bob McGaughey, bmcgaughey@fs.fed.us, Resource Management and Productivity Program

Partners: Fort Lewis Military Reservation, Joint Fire Science Program, Precision Forestry Cooperative, University of Washington, Weyerhaeuser Company

More information: http://www.fs.fed.us/eng/rsac/fusion/

GOAL 3: Develop science-based options for informed management

KEY FINDINGS

- *Homeowners' attitudes toward different fuel treatments differ across the Nation.*
- *New decision-support tool evaluates fire danger and helps land managers prioritize areas for fuel treatment.*
- *Decision-support application delivers rational and transparent funding process for prioritizing treatment of forest fuels.*
- *Fuel treatments in wildland-urban interface in central Oregon may shift wildfire behavior but not reduce its probability.*
- *Fuel Characteristic Classification System facilitates fuel mapping, estimates of fire hazards, and potential ecological effects of fire.*
- *Fire-dependent ecosystems in northeastern Oregon are resilient to various fuel treatments, suggesting additional treatments are needed to reduce fire hazard.*
- *Framework to assess fuel treatment projects used to determine potential effects of treatments on spotted owl habitat.*
- *Fine-scale vegetation maps model fire risk to spotted owl habitat and identify areas at risk of gypsy moth outbreaks in eastern Oregon.*
- *Interior Northwest Landscape Analysis System tools provide a framework for analyzing landscape management scenarios and help translate planning directives into management projects.*
- *As more people recreate on public land, planning methods and tools need to be reevaluated.*
- *Using wood residues to economically generate electricity is a niche operation where feasibility is determined by access to wood, harvesting costs, and capital costs of building the facilities.*
- *Native Douglas-fir will be poorly adapted to climates expected by the end of the 21st century; planting stands with seeds from various locations is one option for preparing for climate change.*
- *Headwater streams play key role in contributing wood to fish-bearing streams.*
- *Continuous, fixed-width riparian buffers appear to offer more protection to aquatic life in headwater streams than intermittent, variable-width buffers or no buffers.*
- *Riparian buffers conserve the diversity of forest mammals along headwater streams in Washington.*
- *New models indicate areas most susceptible to spread of noxious weeds in Crook County, Oregon.*
- *New research highlights ways the Forest Service can administer the National Environmental Policy Act (NEPA) more efficiently.*

Left: Ochoco National Forest. Photo by Tom Iraci. Above: Small log discussion. Photo by Dean L. Parry.

Regional differences found in homeowners' attitudes toward fuel treatments

Fuel treatments at the wildland urban interface are not universally accepted by the homeowners they are intended to benefit. Without public approval, it is difficult for land managers to effectively reduce fire hazard on neighboring public land or to engage homeowners in activities that would reduce fire hazard on private property. To help managers understand and predict homeowners' attitudes toward different types of fuel treatments and their intentions to approve the use of such treatments, scientists developed a survey that was tested and administered in California, Florida, and Michigan.

The survey revealed that California residents tended to have positive attitudes toward mechanical treatments to remove fuel and toward defensible space ordinances that require homeowners to remove flammable vegetation near their homes. Florida residents tended to have more positive attitudes toward prescribed burns, whereas fewer Michigan residents were supportive of mechanical treatments or prescribed burns. Although strong regional differences were observed, nearly all homeowners in the wildland-urban interface were generally supportive of at least one of the fuel management approaches under consideration.

Land managers can use and adapt this survey to poll homeowners living in fire-prone areas around the country. When necessary, managers can follow up with targeted information that may change homeowners' beliefs and attitudes toward fuel management activities.

Contact: Jeremy Fried, jsfried@fs.fed.us, Forest Inventory and Analysis Program

Partners: Cornerstone Strategies, Michigan State University, University of California

Outcome: An adaptable survey allows land managers to assess homeowners' attitudes toward fuel treatments

Roger Ottmar

Foresters learn how to use the Natural Fuels Photo Series to assess fuelbed characteristics during a regional fuels workshop held near Albuquerque, New Mexico.

Education program changes homeowners' attitudes toward fire risks

A dream house in the western foothills or a tinderbox in a fire-prone area? Too often the unsuspecting homeowner in the wildland-urban interface finds the latter description is more accurate. Every summer, wildfire threatens homes that have been built in areas prone to frequent fires. Station scientists and the Colorado Springs Fire Department developed a study to determine if educating the public about fire risk would influence the local housing market.

John Laurence

Smoke from wildfire.

Before the education campaign, housing prices in Colorado Springs were greatest in areas that also had the greatest wildfire risk. Presumably, prospective buyers valued the view afforded by a house on a ridge and were unaware of the increased wildfire risk in such a location. After the education campaign, scientists observed no correlation between wildfire risk and housing price. This suggests that the education campaign successfully changed homeowners' attitudes toward wildfire risk, although there was some evidence that this effect was fading over time.

The Colorado Springs Fire Department has used this study to demonstrate the efficacy of their program and to refine their ongoing educational efforts. The results also may be useful to land mangers trying to raise public awareness about other natural hazards.

Contact: Geoffrey H. Donovan, gdonovan@fs.fed.us, Human and Natural Resources Interactions Program

Partners: USDA Forest Service Rocky Mountain Research Station, National Institute of Standards and Technology, Colorado Springs Fire Department

Outcome: Colorado Springs Fire Department develops an education campaign for informing homeowners about fire risk.

Fuel treatments in wildland-urban interface may change fire behavior but not its probability

Managing dry forests on the eastern slopes of the Cascade Range involves striking a balance between the desired forest structure and the risk of wildfire or insect outbreaks. Management decisions are based on different objectives, environmental settings, social acceptability, and natural disturbances. To help managers weigh all these factors and predict potential outcomes of their actions, the Interagency Mapping and Assessment Project (IMAP) compiled data and developed methods and models for mid- to broad-scale landscape assessment and planning.

The IMAP team assessed 680,000 acres in the central Oregon Cascades using three different management scenarios suggested through public input. The simulations showed (1) fuel treatments in the wildland-urban interface may shift wildfire behavior as fires burn in grass, shrubs, and open forests but may not reduce overall wildfire probability; (2) treatments designed to encourage multistory large-tree forests resulted in increased wildfire and insect outbreaks; and (3) managing toward historical conditions resulted in increases in single-story

large-tree forests and decreases in high-severity wildfire and insect outbreaks.

IMAP models are being used in forest plan revisions for the Umatilla, Malheur, and Wallowa-Whitman National Forests. Models are currently being developed for the Fremont-Winema, Deschutes, and Ochoco National Forests.

Contact: Miles Hemstrom, mhemstrom@fs.fed.us, Focused Science Delivery Program

Partners: Oregon Department of Forestry; USDI Bureau of Land Management; Oregon State University; USDA Forest Service Pacific Northwest Region; The Nature Conservancy; Oregon Natural Resources Institute

Outcome: Three national forests are using IMAP models to evaluate management options.

New tool used to evaluate fire danger and prioritize areas for fuel treatment

FireDanger is a new decision-support system that allows land managers to evaluate the risk of severe wildland fire and prioritize subwatersheds for vegetation and fuels treatments. Scientists used FireDanger to assess 11.8 million acres in the Rocky Mountain region in Utah. Fire danger was assessed for each evaluated watershed in a logic model as a function of three primary topics: fire hazard, fire behavior, and ignition risk. A decision model then summarized fire danger conditions of each watershed in the context of the amount of associated wildland-urban interface. Additional logistical factors such as proximity to population centers, presence of endangered species, slope steepness, and road access may all be taken into account in selection of specific watersheds for treatment. Station scientists and their partners are building a version of this model suitable for all public and private land ownerships in Oregon and Washington.

Contacts: Paul Hessburg, phessburg@fs.fed.us, Managing Disturbance Regimes

Partners: USDA Forest Service Pacific Northwest Research Station, Communications and Applications Program; Rocky Mountain Research Station, Missoula Fire Sciences Laboratory, The LANDFIRE Project, http://www.landfire.gov/

Fuel treatment funding process becomes more transparent

Federal land-management agencies responsible for managing forest fuels have been criticized by oversight agencies such as the General Accountability Office (GAO) for not providing a rational and transparent explanation for their processes of allocating funding for fuel treatment. Responding to this situation, scientists developed a national-level decision-support application for integrated fuel analysis and fuel-treatment planning. The application was specifically designed to provide a rational and transparent decision process. Additionally, the application can be used to evaluate agency performance with respect to fuel-treatment outcomes over the long term, thus supporting a key requirement of environmental management systems.

An initial version of this application tested favorably in 2006 with the Forest Service's Fire and Aviation Management office, regional fuel managers, Congressional staff on natural resource committees, and GAO. Following this success, the modeling process was repeated in 2007 for the Forest Service with some modifications based on feedback from fuel managers. The U.S. Department of the Interior adopted the application in a slightly modified form for use in all of its forest-resource bureaus.

Contact: Keith M. Reynolds, kreynolds@fs.fed.us, Communications and Applications Program

Partners: USDA Forest Service Fire and Aviation Management; USDI Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, and National Park Service

Outcome: Federal land-management agencies look to adopt a transparent funding process for fuel treatments.

Steve Wondzell

Prescribed burn on the Umatilla National Forest.

NEW TOOLS

Fuel Treatment Evaluator (FTE) 3.0

Description: FTE 3.0 was developed to address complicated questions about financing fire hazard reduction treatments. This tool helps users simulate silvicultural treatments and analyze resulting harvest costs and biomass revenue.

Outcomes: FTE 3.0 was used in an assessment of 12 Western States to evaluate treatments to reduce fire hazard and to identify locations where removed products might help offset treatment costs.

How to get it: Visit http://ncrs2.fs.fed.us/4801/fiadb/fire_tabler_us/rpa_fuel_reduction_treatment_opp.htm

Contact: Jamie Barbour, jbarbour01@fs.fed.us, Focused Science Delivery Program

Partners: USDA Forest Service Forest Products Laboratory, Northern Research Station, Rocky Mountain Research Station, and Forest Inventory and Analysis

Digital Fuels Photo Series

Description: The Digital Photo Series (DPS) is a Web-based application that delivers the content from the Natural Fuels Photo Series volumes in an electronic format. The DPS can be used to assess landscape conditions through the appraisal of live and dead fuels and stand characteristics. Although designed for online use, it can also be run from the computer desktop when an Internet connection is unavailable. The DPS currently includes data and images for all 14 published volumes, with 36 series containing a total of 398 sites. The DPS complements the published volumes by adding content and by consolidating fuel and vegetation data in one central location. The application is robust and flexible, allowing for additions of other published photo series or photo-accompanied fuel data. The application has been demonstrated at eight regional fuels workshops, three conference workshops, and the most recent session of Technical Fire Management.

Outcomes: The Digital Photo Series delivers fuel and vegetation structure and composition data to fuel, fire, and natural resource managers and scientists for use in strategic planning, project implementation, and modeling efforts. For example, the underlying fuels and vegetation database has been supplied to developers of the LANDFIRE mapping reference database and the FIRETEC fire behavior simulation model.

How to get it: Contact Clint Wright, cwright@fs.fed.us, Managing Disturbance Regimes Program

Photo Series for Quantifying Forest Residues in Managed Lands of the Medicine Bow National Forest

Description: This photo series presents a visual representation of a range of fuel loading conditions specifically found on the Medicine Bow National Forest. The photos are grouped by forest type and past management practices. This field guide describes the distribution of different types of woody fuels and includes some vegetation data.

Outcomes: Medicine Bow National Forest is using this tool.

How to get it: General Technical Report RMRS-GTR-172. Photo series for quantifying forest residues in managed lands of the Medicine Bow National Forest. http://www.fs.fed.us/rm/pubs/rmrs_gtr172.pdf

Roger Ottmar

Firefighters are briefed before conducting a multiday prescribed burn on the Okanogan-Wenatchee National Forest that tested the Fuel Characteristic Classification System.

Method improved for documenting fuel conditions

The Fuel Characteristic Classification System v. 1.1 (FCCS) documents actual fuel conditions and determines potential fire characteristics. The FCCS contains hundreds of fuelbeds that describe real fuels in six strata from crown to ground, calculations of fire behavior characteristics as a function of environmental conditions, and calculations of fire potentials that express hazard for surface, crown, and available fuels. Older systems only quantified fire behavior for surface fuels, severely limiting their usefulness. The Canadian Journal of Forest Research accepted seven articles documenting the FCCS for publication; these will provide a foundation for the scientific and management communities who use the system.

The Okanogan-Wenatchee National Forest has developed a comprehensive map of FCCS fuelbeds. The Forest Service's Central Oregon Fire Planning Unit is developing a comprehensive map of FCCS fuelbeds that will be used for planning and decisionmaking within the Fire Planning and Analysis program. A large multiday prescribed burning project on the Naches Ranger District of the Okanogan-Wenatchee National Forest used FCCS fuelbeds for assessing fuels and estimating emissions.

Contact: David L. Peterson, peterson@fs.fed.us, Managing Disturbance Regimes Program

Partners: Air Sciences Inc., University of Washington

Outcome: The EPA is using FCCS in a national wildland fire emissions inventory.

Integrating models help predict smoke dispersal from prescribed fires

Air quality restrictions often make it difficult to use prescribed fires to achieve fuel management goals. To manage smoke from prescribed fire, explicit knowledge is required about fuel loading, consumption, and heat release, as well as the ability to predict smoke emissions and dispersal. During two prescribed burns on the Okanogan-Wenatchee National Forest, scientists found that integrating the Fuel Characteristic Classification System (FCCS) and Consume 3.0 provided accurate predictions of fuel loading, fuel consumption, and heat release, which are important inputs required by smoke dispersion models such as BlueSky. A smoke monitoring

NEW TOOL

Fuel Characteristic Classification System (FCCS) v. 1.1

Description: The Fuel Characteristic Classification System (FCCS) v. 1.1 is a tool that enables land managers, regulators, and scientists to create and catalog fuelbeds and to classify those fuelbeds for their capacity to support fire and consume fuels. Version 1.1 refines the system to include calculations of flame length and rate of spread at benchmark environmental conditions for each fuel, and assigns the fire behavior fuel model that is the closest match.

Outcomes: FCCS outputs are being used in a national wildland fire emissions inventory by the Environmental Protection Agency (EPA) and in the development of fuelbed, fire hazard, and treatment effectiveness maps on the Okanogan, Wenatchee, and Deschutes National Forests. It is also being used for the eastern Oregon local fire planning unit test area for the Fire Planning Analysis program. The Landscape Fire and Resource Management Planning Tools Project, a multipartner project, is using FCCS to produce consistent and comprehensive maps and data describing vegetation, wildland fuel, and fire regimes across the United States. The system has been taught at 5 regional fuels workshops and 12 regional and national training sessions. The University of Idaho has incorporated FCCS into a two-credit continuing education class.

How to get it: Visit http://www.fs.fed.us/pnw/fera/fccs/, or Roger D. Ottmar, rottmar@fs.fed.us, Managing Disturbance Regimes Program

Roger Ottmar

A multiday prescribed burn on the Okanogan-Wenatchee National Forest also enabled scientists to test the BlueSky smoke dispersal model. Here field crew collect fuel samples to determine moisture content prior to the burn.

system was implemented, and more than 20 BlueSky forecast scenarios were run each day for the burning effort using ignition pattern and timing scenarios jointly designed by fuel managers and PNW scientists.

This project tested the integration of several new procedures and tools to increase the likelihood of conducting multiday, landscape-scale prescribed burns with minimal effects to air quality. The findings from this project will be used to improve the Okanogan-Wenatchee National Forest smoke management program and revise the BlueSky model. The model will be released to all users including USDA Forest Service, Fire Consortia for Advanced Modeling of Meteorology and Smoke (FCAMMS), the National Weather Service, Environmental Protection Agency, and Northwest AirPact.

Contacts: Roger Ottmar, rottmar@fs.fed.us, Managing Disturbance Regimes Program

Partners: Washington Department of Natural Resources; Washington Department of Environmental Quality; USDA Forest Service Pacific Northwest Region and Okanogan-Wenatchee National Forest; Northwest Coordination Center; National Weather Service

Fire-dependent ecosystems in northeastern Oregon are resilient to fuel treatments

Prescribed burns, burning plus thinning, and thinning are the three most commonly used fuel reduction techniques in the West. The questions are, how effective are these treatment in a given situation, and what effect do they have on the residual stands? Scientists used the Fuel Characteristic Classification System (FCCS) to assess changes in fire hazard resulting from the three treatments and an untreated control when applied to a ponderosa pine forest in northeastern Oregon. They found that although fire hazard may decline in the short term, the treatments did not significantly reduce fire hazard over the long term. This suggests that more aggressive treatments or repeated application of treatments may be needed to reduce fuels and create more sustainable forest structure.

The study did find a difference between fuel treatments and the residual forest stands. Burning and burning plus thinning treatments increased the proportion of dead trees, whereas the proportion of dead trees declined or remained constant in thinned and control units. Most new tree mortality occurred within 2 years of treatment and was attributed to bark beetles. Bark beetle-caused tree mortality, although low overall, was greatest in the burning plus thinning treatment.

This study was part of the national Fire and Fire Surrogate study, which is assessing fuel reduction techniques, economics associated with different treatments, wildfire behavior, and forest health and forest restoration efforts, along with other issues and methods for integrating these results into decision-support tools.

Contact: Andrew Youngblood, ayoungblood@fs.fed.us, Managing Disturbance Regimes Program

Partners: Joint Fire Science Program

Steve Wondzell

A field crew checks a silt fence to evaluate erosion at a study plot on the Umatilla National Forest.

Prescribed fire has little effect on erosion in the absence of major storms after treatment

Prescribed fire is often proposed as a treatment for restoring forest health and reducing long-term risk of wildfires. It is generally assumed that wildfires and wildfire-related erosion pose greater threats to water quality and fish habitat than prescribed fires. This study in the Blue Mountains of northeastern Oregon and southeastern Washington was designed to quantify background erosion rates and to examine the effects of prescribed fire on hillslope erosion and stream sedimentation. Preliminary analyses indicated that erosion rates were significantly related to aspect and amount of bare ground but were not significantly influenced by prescribed fire. Vegetative ground cover grew back quickly in the years following fire. Consequently, the window of time during which treated areas are at risk of accelerated erosion following prescribed fire appears to be relatively short.

Data from this study have been used to help calibrate the WEPP model for background erosion rates and the effects of prescribed fire

on hillslope erosion for volcanic-ash-derived soils. The data and WEPP model also contributed to analysis on erosion and sedimentation for the School Fire salvage logging environmental impact statement and subsequent litigation.

Contact: Steve Wondzell, swondzell@fs.fed.us, Aquatic and Land Interactions Program

Partners: USDA Forest Service Umatilla National Forest, Rocky Mountain Research Station, and Moscow Forestry Sciences Laboratory

Fertilization after severe wildfires can accelerate the development of plant cover and help reduce soil erosion hazards

Slope stabilization treatments often are applied after high-severity wildfires to reduce soil erosion, protect water quality, and reduce risks to human life and property resulting from landslides. The effectiveness of many common slope stabilization treatments remains in question, however, and high costs limit the extent to which some popular treatments, like aerial mulching, can be used. In a study of seeding and fertilization treatment effects following the 2004 Pot Peak Fire near Chelan, Washington, scientists found that fertilizing with nitrogen and sulfur increased plant cover significantly during the first two growing seasons following the severe wildfire. Fertilization alone was more effective than seeding alone; however, spreading fertilizer and yarrow seeds, a native forb, produced the greatest increase in plant cover.

If further studies can establish the consistency of these results, fertilization can provide a viable alternative to seeding or mulching as a slope stabilization treatment. Fertilizer is widely available and relatively inexpensive to purchase and apply, and carries low risk of introducing exotic plant species into severely disturbed landscapes. Ongoing studies will help us better understand possible secondary effects (good or bad) of fertilization on vegetation composition and succession.

Contact: Dave W. Peterson, davepeterson@fs.fed.us, Managing Disturbance Regimes Program

Partners: USDA Forest Service Okanogan-Wenatchee National Forest, University of Washington

Dave W. Peterson

A study after the 2004 Pot Peak Fire near Chelan, Washington, found that fertilization accelerated plant regrowth.

NEW TOOL

SMARTFIRE

Description: Fire information is available from ground-based reporting systems, satellite fire detections, incident command teams, and other sources, each of which has its strengths and weaknesses. The Satellite Mapping Automatic Reanalysis Tool for Fire Incident Reconciliation (SMARTFIRE) is a new tool for integrating and reconciling all sources of fire information. By selectively weighting the different sources based on their inherent strengths, SMARTFIRE creates a single fire database that contains the most complete and best possible information. SMARTFIRE currently reconciles ground-based reports such as the incident command system reports and those from prescribed burn systems with satellite-based fire detections made available through the National Oceanic and Atmospheric Administration Hazard Mapping System. SMARTFIRE output is available on a daily, real-time basis.

Outcomes: The Environmental Protection Agency is examining SMARTFIRE for use in its national emissions inventory. When SMARTFIRE is used with the BlueSky smoke modeling framework, BlueSky appears to better predict surface smoke concentrations. The National Weather Service will be evaluating SMARTFIRE for use in National Air Quality forecasts.

How to get it: Contact Sim Larkin, larkin@fs.fed.us, Managing Disturbance Regimes Program

New model improves estimation of wood quality and fire risk

The size, location, and condition of knots are important factors in determining wood quality. Although individual tree stand simulation models have been used for almost 30 years, very little research has been done on modeling crown dynamics in individual trees or knots formed by the branches. Without detailed information on crown dynamics, it is difficult to improve predictions of wood quality in these simulation models. A second need for this information is its use in determining the probability of crown torching in fire-risk models.

To meet these needs, scientists developed a dynamic crown model that is general enough to fit into the major stand simulation models used in the Northwest. This model can provide key information for both wood quality and fire-risk modules under a variety of management alternatives.

Contact: Robert A. Monserud, rmonserud@fs.fed.us, Human and Natural Resources Interactions Program

Partner: Oregon State University

Fuel reduction treatments affect elk and mule deer differently

Manipulation of forest habitat via mechanical thinning or prescribed fire for fuels reduction has become increasingly common across western North America. This study evaluated seasonal and spatial responses of North American elk and mule deer to thinning and burning of true fir and Douglas-fir stands that contained high levels of dead fuel. Results indicated that although elk altered their home

Frank Vanni

Elk at Starkey Experimental Forest and Range.

range to include areas that had been treated, they did not use the treated area within their home range more than untreated areas. Seasonal and multiple environmental factors such as distance to roads, steeper slopes, and topographical complexity also contributed to home range establishment. It appears that manipulating forest habitat with prescribed fire may be of greater benefit to elk than mule deer where these species are found in the same area. Therefore, maintaining a mixture of burned and unburned habitat may provide better long-term foraging opportunities for both species than burning a large proportion of a landscape. This research will help forest managers plan fuel reduction projects in the future to ensure that habitat values for elk and mule deer are maintained or enhanced.

Contact: John Kie, kiejohn@isu.edu, Marty Vavra, mvavra@fs.fed.us, Managing Disturbance Regimes Program

Partners: Joint Fire Science Program, University of Idaho, Rocky Mountain Elk Foundation, Idaho State University

Vegetation maps facilitate modeling of fire risk to owl habitat and risk of gypsy moth outbreak

Station scientists identified the need for geospatial vegetation data that could be used to model interactions between potentially severe disturbances such as wildfire and insect outbreaks and their impacts on resource values. Therefore, they used a mapping method that links forest plot data with satellite imagery to produce a series of vegetation maps at 30-meter resolution for central, eastern, and southern Oregon; Washington; and northern California. These maps provide detailed information on the distribution of vegetation and stand composition, which allowed scientists to model the risk of fire to existing spotted owl habitat and identify areas at risk of gypsy moth outbreaks. This information enables land managers to focus related management efforts in areas where they will be most effective.

Contact: Jerome S. Beatty, jbeatty@fs.fed.us, Western Wildlands Environmental Threat Assessment Center

Partners: Landscape Ecology, Modeling, Mapping, and Analysis Team, Oregon State University; USDA Forest Service Remote Sensing Application Center

Fuel treatments can protect spotted owl habitat

Natural disturbances such as wildfire are a growing threat to the habitat of many rare wildlife species. Although fuel treatments and other management activities can reduce wildfire impacts, designing effective treatment strategies on large complex landscapes is challenging. Scientists are developing a new wildfire risk assessment framework for measuring the performance of alternative fuel treatment strategies using formal risk science. The framework can be applied to wildlife habitat and other resource values at risk to find fuel management strategies that best meet habitat conservation goals.

In a case study on the Deschutes National Forest, the risk analysis indicated that strategic fuel treatments on 10 percent of the project area, excluding habitat

Tom Iraci

Northern spotted owl.

Left: Mack Creek old growth, H.J. Andrews Experimental Forest, Oregon. Photo by Tom Iraci.

NEW TOOL

Guidelines for developing and updating Bayesian network models

Description: Bayesian network models are based on Bayesian statistics and allow the user to model events in terms of probabilities of different outcomes. A Station scientist and his colleagues have developed, published, and implemented practical guidelines for creating, evaluating, validating, and updating Bayesian network models.

Outcomes: The Oregon Department of Forestry has asked for help in developing Bayesian network models to determine the overall efficacy of their forest management in terms of ecological, social, and economic outcomes. Washington Department of Fish and Wildlife has asked for guidance in developing wildlife habitat prediction models for groups of wildlife species; U.S. Fish and Wildlife Service is using the Bayesian network approach to model decisions about listing species as threatened or endangered; and U.S. Geological Survey used this research to build comprehensive models of probable relationships between polar bear populations, amount of arctic sea ice, and global climate change.

How to get it:

Marcot, B.G.; Steventon, J.D.; Sutherland, G.D.; McCann, R.K. 2006. Guidelines for developing and updating Bayesian belief networks applied to ecological modeling and conservation. Canadian Journal of Forest Research. 36: 3063–3074.

Marcot, B.G. 2006. Characterizing species at risk I: modeling rare species under the Northwest Forest Plan. Ecology and Society. 11(2): 10. http://www.ecologyandsociety.org/vol11/iss2/art10/.

Contact Bruce Marcot, bmarcot@fs.fed.us, Ecosystem Processes Program

of the northern spotted owl, reduced the probability of owl habitat loss from fire by almost 30 percent, compared to no treatment. Results from the risk assessment were used to support the preferred alternative in the final environmental impact statement for the Five Buttes Interface project. This work paves the way for future wildfire risk analysis to support fuel treatment projects. The risk assessment framework can be applied elsewhere to quantify potential benefits of wildland fires and to study social and ecological issues related to wildfire impacts.

Contact: Alan Ager, aager@fs.fed.us, Western Wildlands Environmental Threat Assessment Center

Partner: USDA Forest Service Rocky Mountain Research Station

Outcome: Deschutes National Forest uses new risk assessment framework to assess probability of lost owl habitat from wildfire with or without fuel treatment projects.

Forest structure limits populations of flying squirrels, primary prey of spotted owl

Northern flying squirrels are a central part of the spotted owl-squirrel-fungi-tree linkage and are, thus, thought to be important to the long-term ecological health of the region's forests. To study the impact forest management practices can have on this nocturnal rodent, scientists collected data from live trapping, radio-tracking studies, and vegetation surveys in western Washington from 1991 to 2006. These data were added to a three-dimensional computer model.

Scientists found a positive association between high squirrel densities and complex interactions among forest structural components that appear to make squirrels less vulnerable to predation. Removal of structure, either through

natural or human-induced processes, reduced squirrel populations.

Models such as the one developed in this project help provide a quantitative basis for forest management designed to promote habitat for species of concern, such as the northern spotted owl.

Contact: Todd M. Wilson, twilson@fs.fed.us, Ecosystem Processes Program

Partners: U.S. Army, Fort Lewis; USDA Forest Service Olympic National Forest

Insect-induced tree mortality and loss of canopy closure not necessarily detrimental to pileated woodpeckers

The pileated woodpecker is a species of conservation concern and an indicator of mature- and old-forest habitat conditions in the Pacific Northwest. Effects of natural and human-caused disturbance on density of nesting pairs, reproductive success, and traditional home ranges were compared over 30 years in two areas and over 15 years in five additional areas. Harvesting, particularly regeneration cuts, which lead to the development of new stands, and loss of dead trees and logs were detrimental to the woodpecker. In one area, density of nesting pairs decreased after extensive timber harvests eliminated most of the stands of mature and old-growth grand fir and reduced the density of nest and roost trees and foraging substrate since 1990. Density of nesting pairs, reproductive success, and home range location remained fairly consistent over 30 years in a second area with extensive tree mortality resulting from insect outbreaks but without regeneration harvests. The woodpeckers had greater reproductive success between 2003 and 2005 in areas where less harvest had occurred and where there were more closed-canopy stands within their home ranges.

Given the USDA-USDI 2001 National Fire Plan, the Healthy Forest Restoration Act of 2003, and management emphasis on fuel management and forest restoration, large areas have or will be subject to fuel reduction activities. Findings from this long-term study will be useful to wildlife biologists and resource managers as they manage for multiple goals.

Contact: Evelyn Bull, ebull@fs.fed.us, Managing Disturbance Regimes Program

Partners: USDA Forest Service Pacific Northwest Region; University of Idaho

NEW TOOL

Image-driven screening aid for identifying common and selected exotic species of wood-boring buprestid beetles

Description: Wood-boring buprestid beetles (e.g., emerald ash borer) can have significant ecological and economic impacts on forest resources. This identification aid includes more than 20 of the most common PNW buprestid species and selected exotic species. This image-driven key was developed in PowerPoint, a format that is widely available. This screening aid enables non-entomologists to sort up to 95 percent of specimens collected in surveys or studies. This relieves the limited number of taxonomic experts from conducting time-consuming coarse sorts and instead enables them to concentrate on target species.

Outcomes: This project supports the Forest Service's Early Detection/Rapid Response effort in providing taxonomic keys for prescreening collections. Similar support will be provided for various state surveys, such as the National Exotic Woodborer and Bark Beetle Survey conducted by the Cooperative Agricultural Pest Survey program.

How to get it:

Contact Christine G. Niwa, cniwa@fs.fed.us, Managing Disturbance Regimes Program

New tools help translate planning directives into management projects

Forest managers want to know if their management activities are having the intended result or creating the desired condition. It is difficult, however to conduct broad-scale, multidisciplinary evaluations of management practices. Scientists developed the Interior Northwest Landscape Analysis System (INLAS) project to address this challenge. INLAS provides intermediate-scale assessments that can help translate broad-scale planning directives into specific management projects.

Miles Hemstrom

The Interior Northwest Landscape Analysis System (INLAS) was applied to management scenarios in the Blue Mountains in northeastern Oregon to determine if management activities were creating the desired results.

The INLAS tools were applied to management scenarios in the Blue Mountains of northeast Oregon. Several key findings emerged from these simulations: (1) fire suppression alone does not produce abundant large tree structure; (2) maintaining abundant large-tree multistoried structure in cool, moist forests is likely to be difficult because of wildfire and insect outbreaks; and (3) both active fuel treatment and passive management scenarios increased the proportion of large-tree single-story forests in dry forest conditions.

Some INLAS tools have been used in other assessments, and some INLAS case studies have been integrated into Forest Service planning tools for vegetation, wildlife habitat, and wildfire. INLAS case studies also have been incorporated with nationwide training programs for the Fireshed Assessment process, and the Interagency Mapping and Assessment Project.

Contact: Miles Hemstrom, mhemstrom@fs.fed.us, Focused Science Delivery Program

Partners: Oregon State University, University of Georgia, USDA Forest Service Pacific Northwest Region and Rocky Mountain Research Station, USDI National Park Service, Oregon Department of Forestry

NEW TOOL

Gradient Nearest Neighbor maps of forest vegetation for the state of Oregon

Description: Detailed maps of forest composition and structure for research and management applications, including landscape scenario analysis; forest policy analysis; land management and conservation planning; and risk assessment for fire, insects, disease, and climate change.

Outcomes: Used in a wide variety of analyses, such as the Interagency Mapping and Analysis Project (IMAP), Effectiveness Monitoring for the Late-Successional Forests under the Northwest Forest Plan, National Forest Plan revision, forest health risk assessment, dead wood habitat assessment using DecAID.

How to get it: Download maps, accuracy assessment, metadata, and other information from http://www.fsl.orst.edu/lemma/, under the link for the GNNPac project, or contact Janet Ohmann, johmann@fs.fed.us, Ecosystem Processes Program

2.5-acre forest aggregates retained during harvest provide conditions suitable for species maintenance

Leaving aggregates of undisturbed forest after timber harvest to serve as refugia for sensitive species is a practice increasingly considered by forest managers. The success of these plots as refugia lies in their ability to maintain the same environmental conditions found in mature, intact forest.

Scientists compared conditions inside 2.5-acre plots to those in adjacent harvested areas and to larger tracts of undisturbed forest. After measuring microclimatic variables such as light availability and temperature, they determined that 2.5-acre aggregates are sufficiently large to contain areas with light, temperature, and soil moisture that are comparable to those in undisturbed forest. These areas, they found, would be suitable for the short-term persistence of forest-dependent species.

Current retention standards in the Northwest Forest Plan allow for retention of forest aggregates as small as 0.5 acre. These results suggest that microclimatic conditions in aggregates this small would be severely compromised. Findings from this study can be used to develop retention guidelines that better meet management objectives.

Contact: Troy Heithecker, theithecker@fs.fed.us, Resource Management and Productivity Program

Partners: Oregon State University; University of Oregon; University of Washington; USDA Forest Service, Gifford Pinchot and Umpqua National Forests and Pacific Northwest Region; Washington State Department of Natural Resources

Snag density declines with timber harvest and human access

Many wildlife species depend on snags (standing dead trees) for habitat. Research suggests, however, that snag density is lower in areas of intensive timber harvest and where humans have access to cut firewood. Scientists evaluated these potential relations by sampling stands with different levels of timber harvest and access in national forests in the Northwestern United States. Stands with no history of timber harvest had 3 times as many snags as in stands selectively harvested, and 19 times as many snags as in stands that had been completely harvested. Stands not adjacent to roads had three times as many snags compared to stands adjacent to roads.

Evelyn Bull

Snags are important habitat to a variety of wildlife. Scientists found fewer snags in areas readily accessed by humans.

This information is being used by national forests in eastern Oregon, eastern Washington, Idaho, and western Montana as part of forest planning, revisions, amendments, and environmental assessments and impact statements to help mitigate past snag loss and to improve snag retention during management activities.

Contact: Michael Wisdom, mwisdom@fs.fed.us, Managing Disturbance Regimes Program

Partners: Wildlife Consulting, Inc.; USDA Forest Service Washington office

Outcome: National forests are revising management to improve snag retention.

Recreation is emerging as a key management issue

More people are recreating on public land, and the range of activities they are engaging in is expanding. This increasing diversity of both people and activities has highlighted the need to reevaluate planning methods and tools and to assess the role of recreation within the Forest Service's planning and administrative processes. To address this, scientists systematically compared the premise, development, strengths, and weaknesses of the major recreation planning frameworks used by land management agencies. Conceptual needs for

meeting future recreation goals were presented at the National Workshop on Recreation Research and Management.

Scientists have shared their findings about the effectiveness of different planning methods and ways to incorporate ecosystem management principles in the selection and use of planning tools at the Outdoor Recreation Short Course for Mid Career Professionals in Logan, Utah, and the Continuing Education for Ecosystem Management Short Course in Flagstaff, Arizona. Results were also presented to the Dixie National Forest Travel Management Taskforce and at the Science Forum for the Grand Staircase-Escalante National Monument. For 2008, scientists have been invited to share these findings with the Forest Management Teams for the Mount Baker-Snoqualmie and Olympic National Forests, and the Forest Service's Interregional Ecosystem Management Coordinating Group.

Contact: Dale Blahna, dblahna@fs.fed.us, Human and Natural Resources Interactions Program

Partners: University of Montana, Department of Society and Conservation; Utah State University, Department of Environment and Society and Department of Sociology, Social Work, and Anthropology

People form relationships with the land during nature-based recreation

Understanding how and why people become attached to certain places can help land management agencies anticipate how people will react to management proposals. Scientists found that tourists, as well as seasonal and year-round residents identified natural areas where they recreated as special places. Working with this conception of recreation as a place-making and a community activity, scientists developed a matrix that provides analytical tools for integrating theories of place and community. The matrix helps integrate exploration across categories of place (physical setting, interactions and behaviors, meanings and evaluations) and community (local ecology, local society, and community action). The matrix was conceived as an aid for crafting land-use policy that will be better understood, easier to implement, and more successfully involve the public, particularly in volunteer programs.

Contact: Linda E. Kruger, lkruger@fs.fed.us, Human and Natural Resources Interactions Program

Partner: Pennsylvania State University

Sara Jovan

Field crew members drill each other on identification of lichens.

David Nicholls

Home show attendees preferred wood panels with knots, distinct grains, and contrasting colors.

Consumers prefer decorative wood products with character

Traditionally, wood products were valued for their high strength, clear grain, consistent color, and lack of knots. Deviations from this were considered imperfections and thus given a lower grade and sold for a lower price. Continuing research on hardwood utilization indicates that when it comes to lumber for furniture and paneling, consumers often prefer lumber with character. In surveys conducted at home shows, respondents consistently preferred cabinets and panels with knots, distinct grain, and contrasting colors in the heartwood and sapwood.

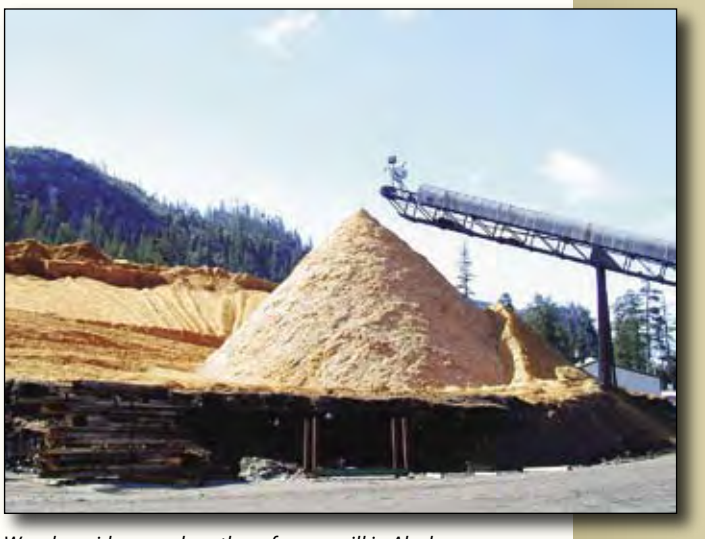
Understanding consumer preference allows small lumber producers to increase their profit margins by converting lower grade lumber to value-added products, such as paneling, to sell to local markets and wholesalers.

Contact: David L. Nicholls, dnicholls@fs.fed.us, Human and Natural Resources Interactions Program

Partners: University of Alaska Cooperative State Research, Education, and Extension Service Forest Products Program

Scientists explore feasibility of using wood for power generation

Woody residues from timber harvest, hazardous fuel removal, and wood products manufacturing can be used to generate electricity. The question is, when is it economically feasible in a given location? Scientists examined the feasibility of using woody biofuels for direct-combustion electrical or thermal power applications at several different scales: large-scale electrical power generation at stand-alone facilities, co-generation to produce steam and electrical power, and smaller scale thermal heating projects at government facilities and schools. They found that for such a project to be economically feasible, the source of wood had to be very close to the power-generating facility, harvesting costs had to be very low, which is not often the case with hazardous fuel removal, and the costs of building and maintaining the generating facility had to be low. The most promising use for woody biofuels currently appears to be in smaller scale projects such as generating heat for schools.



David Nicholls

Woody residues, such as these from a mill in Alaska, can be used to generate electricity.

As the country looks to develop alternative fuel sources, the information generated from studies like these plays an invaluable role in helping bioenergy projects find an appropriate niche.

Contact: David L. Nicholls, dnicholls@fs.fed.us, Human and Natural Resources Interactions Program

Partners: The Sitka Wood Utilization Center

Oval logs produce more lumber than round logs of same volume

Over the years sawmillers have, by trial and error, determined the best way to cut logs to produce the most useable lumber. For oval-shaped logs, primary sawing along the longer axis has generally been accepted as the "correct" method. Scientists verified this by applying a series of sawing simulations to five replicate groups of oval logs, modeled from measurements of 52 western hemlock logs. Using

Sawing simulations revealed the optimal log orientation for producing lumber.

AUTOSAW, the log models were sawn in a series of simulations that altered log orientation and elliptical representations. Scientists found oval logs tended to produce more lumber than round logs when rotated to their optimal orientation. In fact, the more oval the log, the greater the amount of lumber it yielded, compared to a round log of the same volume.

This information indicates the oval logs should not be downgraded as other literature has suggested. These finding were published in the Forest Products Journal and presented to the Timber Measurements Society.

Contact: Robert A. Monserud, rmonserud@fs.fed.us, Human and Natural Resources Interactions Program

Partners: New Zealand Forest Research Institute (Scion and Ensis)

Left: Photo by Charlie Crisafulli.

Regional Agenda2020 partnership is strengthening forest products industry

Agenda2020 is a national partnership committed to sustainable forestry and its application in the United States. Funded by the Forest Service and the American Forest and Paper Association, the partnership fosters research exploring numerous high-priority areas, including soil and tree productivity, molecular biology, and biotechnology. The Forest Service's western research stations and area universities are among the partnership's many members.

In 2007, the Station's Regional Agenda2020 members successfully completed a dozen projects that explore long-term site productivity, genetics, and tool development. Results and technologies from the Agenda2020 partnership are being used by the forest products industry to sustainably manage for wood production and maintain competitive strength in a global market. More broadly, results from Agenda2020's work are helping the country to reduce its dependency on fossil fuels, increase carbon sequestration, promote sustainable development in rural communities, and increase the global competitiveness of the forest products industry.

Contact: Charley Peterson, cepeterson@fs.fed.us, Resource Management and Productivity Program

Partners: American Forest and Paper Association, National Council on Air and Stream Improvement, Oregon State University, University of Idaho, University of Washington

Native Douglas-fir will be poorly adapted to climates expected by end of 21st century

Climates are expected to warm considerably over the next century, suggesting that today's plant populations will not be adapted to future conditions.

Scientists studied the potential risk of maladaption of native Douglas-fir by comparing populations grown together and looking at the relationship of population variation in adaptive

traits and the environments of seed sources. They found the risk to be large for most adaptive traits relative to the risk associated with transfers within current seed zones, particularly for the more drastic climate change scenarios. Uncertainty remains, however, with respect to specific climate projections and appropriate timeframes to consider for adaptive responses.

Management options to prepare for a warming but uncertain future climate include increasing within-stand diversity by planting mixtures of local seeds and seeds from lower elevations or farther south.

Contact: Brad St. Clair, bstclair@fs.fed.us, Resource Management and Productivity Program

Partner: Oregon State University

Understanding why Alaska yellow-cedar is declining leads to conservation strategy

The decline of yellow-cedar in southeast Alaska illustrates how a minor shift in climate can have serious and unanticipated consequences on forest ecosystems. As scientists better understand the cause of the decline, they are developing a conservation strategy for this economically and culturally valuable species. Cumulative research is revealing that spring freezing injury induced by a warming climate and reduced protective snow is the cause of the widespread yellow-cedar mortality. This knowledge, combined with assessment of decline at several spatial scales, is leading to a strategy that involves partitioning the landscape into areas that are favorable and unfavorable for yellow-cedar, harvesting some of the dead forests, and actively regenerating cedar in areas suitable for long-term cedar viability.

This strategy may eventually be implemented by Forest Service and other land managers in southeastern Alaska and adjacent areas of British Columbia to conserve and manage yellow-cedar in the context of climate-induced mortality.

Contacts: Paul Hennon, phennon@fs.fed.us, Managing Disturbance Regimes Program; David D'Amore, ddamore@fs.fed.us, Resource Management and Productivity Program

Partners: British Columbia Forest Service; USDA Forest Service Tongass National Forest, Forest Products Laboratory, and Northern Research Station; University of Vermont; University of Alaska Fairbanks; The Nature Conservancy;

More information: *Science Findings* No. 93 (May 2007), The Mysterious Demise of an Ice Age Relic: Exposing the Cause of Yellow-Cedar Decline, http://www.fs.fed.us/pnw/sciencef/scifi93.pdf

Outcome: Research leads to strategy for managing for Alaska yellow-cedar in a changing climate.

David D'Amore

Standing dead yellow-cedar interspersed with healthy western hemlock are a common sight on low-elevation hillslopes in southeast Alaska.

Headwater streams contribute wood to fish-bearing streams

Large wood in streams creates desirable habitat for salmon. Its presence slows water and creates pools, which give fish places to rest and hide. Forest management within a watershed can affect the size and amount of wood that eventually ends up in a fish-bearing stream. The question is, at what spatial scale within a watershed can landscape features best explain habitat features in fish-bearing streams? In southwestern Oregon, scientists found that an intermediate spatial scale, which included headwater streams draining directly into surveyed fish-bearing streams, best explained the presence of large wood in fish-bearing streams.

These findings will help managers decide where management within a watershed will most effectively contribute to desirable stream habitat. This multiscale approach is being explored to reduce monitoring costs and target field monitoring locations as part of the Aquatic and Riparian Effectiveness Monitoring Program for the Northwest Forest Plan.

Contact: Kelly Burnett, kmburnett@fs.fed.us, Aquatic and Land Interactions Program

Partners: Aquatic and Riparian Effectiveness Monitoring Program (a partnership of federal land management agencies); Oregon State University; USDA Forest Service Pacific Northwest Region; USDI Bureau of Land Management Oregon State Office

Alex Foster

Large wood in streams helps create desirable habitat for salmon.

Buffers along headwater streams protect amphibians and invertebrates from effects of upslope timber harvests

Headwater streams have an ecology distinct from larger streams within the watershed. They also contribute critical nutrients to fish-bearing streams farther downstream. Retention of vegetation in streamside buffer zones can minimize the effects of forest management activities on the stream. Although the establishment of riparian buffer zones has been a required forestry practice for more than a decade, the benefits of different riparian buffer widths for headwater wildlife and habitats were relatively untested. In particular, the relation between buffer widths necessary to maintain headwater wildlife with different forestry activities was unknown.

Scientists conducted several studies in northwest Oregon to address these issues. At study sites from near Mount Hood in the Cascade Range to near Coos Bay in the Coast Range, they characterized headwater amphibian communities and found that riparian buffers as narrow as 20 feet retained amphibian diversity and habitat when upland forests were thinned. Another study near Sweet Home, Oregon, found that a 98-foot buffer protected riparian invertebrate communities from the impacts of a clearcut forest harvest. This information helps forest managers develop management plans that protect wildlife diversity and habitat while also managing timber resources.

Contact: Deanna H. Olson, dedeolson@fs.fed.us, Aquatic and Land Interactions Program

Partners: USDI Bureau of Land Management, USDA Forest Service Siuslaw and Willamette National Forests, Oregon State University, Oregon Headwaters Research Cooperative

Sara Jovan

Hall's lung lichen (Lobaria hallii).

NEW TOOL

Sediment and wood delivery from headwater streams model

Description: This model for western Oregon predicts the likelihood of a debris torrent in a given headwater stream reaching a fish-bearing stream. It also estimates the amount of wood that will be delivered to the channel.

Outcomes: The model allows for the development and evaluation of options for managing headwater streams within a given watershed or across a large area and for evaluating the potential cumulative impact of forest management. The model is being used extensively by the Bureau of Land Management in Oregon to develop and evaluate options for their revised land management plan.

How to get it: Contact Kelly Burnett, kmburnett@fs.fed.us, Aquatic and Land Interactions Program

Alex Foster

Amphibians and invertebrates benefit from riparian buffers after upslope timber harvests.

Continuous riparian buffers protect aquatic life better than variable-width buffers

Riparian trees and shrubs play an important role in aquatic ecosystems. Stream-side vegetation within a riparian zone shades the stream, while fallen branches and leaf litter provide structure and nutrients in the immediate vicinity and farther downstream. In this study, scientists found that aquatic life in headwater streams of the Washington Coast Range appeared better protected by continuous, fixed-width riparian buffers than by either intermittent, variable-width buffers or no buffers. The quantity and composition of organic litterfall was strongly influenced by the amount of riparian forest retained with fixed-width buffers providing the greater amounts of organic matter, but temperature changes were detected only in streams with no buffers. Fewer mollusks and millipedes were found after timber harvest, especially at sites without springs or seeps, regardless of the type of buffer provided.

Contact: Pete Bisson, pbisson@fs.fed.us, Aquatic and Land Interactions Program

Partners: Washington Department of Natural Resources, Washington Department of Ecology, University of Washington

Outcome: Buffer information is being used by the Washington Department of Natural Resources to prescribe headwater stream protection requirements in its 50-year habitat conservation plan for managing headwater streams.

Alex Foster

Millipede.

Tom Iraci

Maybeso Experimental Forest, Alaska.

Stream buffers conserve diversity of forest mammals

The ability to gauge the response of forest-floor wildlife to changes in streamside habitat is critical to determining the efficacy of aquatic conservation strategies. These strategies often involve the creation of buffers—natural areas surrounding streams that protect them and their inhabitants from the effects of land management activities.

To study the effectiveness of buffers in conserving small mammals, scientists compared capture rates of mammal species along streams before and after the creation of buffers. They found that species diversity increased in streams with buffers and was greatest within 3 years of creation. Scientists also noted that capture rates tended to vary greatly among the streams, meaning very large effects would be needed to detect differences following disturbance.

This research supports efforts to develop a long-term stream conservation strategy as part of the Washington Department of Natural Resources' habitat conservation plan and to support the agency's adaptive management strategy.

Contact: M.G. Raphael, mraphael@fs.fed.us, and R.J. Wilk, rwilk@fs.fed.us, Ecosystem Processes Program

Partner: Washington Department of Natural Resources

Synthesis of research on amphibians provides alternative management approaches

Forty-seven species of amphibians live in the Pacific Northwest and spend some portion of their life in riparian areas. Streams create microclimates of cool, moist air that permeates upslope to warmer, drier areas. These microclimates appear particularly important to amphibians that breed in streams but can disperse hundreds of yards into upland forests, if the habitat is present.

A synthesis of recent studies on amphibians and microclimates associated with headwater streams suggests a two-pronged management approach for forested headwaters in the Pacific Northwest. One is a conservative approach designed to provide maximum benefits to targeted amphibians potentially at risk, whereas the other is for landscapes where timber harvest is a priority. Key to both of these approaches is providing connected avenues of trees both along streams and across ridgelines to other headwaters. Aggregated and dispersed retention of trees along channels and upslope to provide dispersal habitat for amphibians may effectively retain these unique taxa and the habitat and microclimates they require.

Contact: Deanna H. Olson, dedeolson@fs.fed.us, Aquatic and Land Interactions Program

Partners: USDI Bureau of Land Management, Pacific Rivers Council, USDA Forest Service Siuslaw National Forest and Pacific Southwest Research Station

New tools enhance FishXing software

FishXing helps engineers**,** hydrologists, and fish biologists design and evaluate culverts that fish and other aquatic organisms can pass through safely. In 2007, scientists created several new tools to further enhance the usability of the software. One of these tools is a 300-page help manual. It is built into the software and includes a comprehensive synthesis of the literature on fish performance vs. culvert hydraulics.

Peter Bisson

Cutthroat trout and Chinook salmon.

Organized in table format, the help manual allows users to select the literature that best fits their situation. Internet search engines give priority ranking to the help manual for many of the key terms included in its index; this results in extensive online traffic from users around the world.

The FishXing Web site now includes 29 case studies that facilitate advanced training for Aquatic Organism Passage design and construction. The case studies demonstrate the application of accepted design techniques for passage of fish and other aquatic organisms, ways to approach challenging site constraints, lessons learned, and pitfalls to avoid. The case studies highlight successful solutions as well as techniques that did not work as expected. Another 20 case studies are in the works.

A third new tool is a comprehensive, interactive online guide to field techniques for collecting data of inventory and assessment of culverts. These learning resources widen the FishXing user base, and help to ensure it is used as intended.

Contact: Michael Furniss, mfurniss@fs.fed.us, Communications and Applications Program

Partners: San Dimas Technology and Development Center and the Federal Highway Administration

More information: Visit http://stream.fs.fed.us/fishxing/

Maps and expansion models aid weed management

Noxious, invasive weeds can sicken livestock, contaminate agricultural exports, and out-compete native vegetation. Crook County in central Oregon is particularly susceptible to invasive weeds because of its location, climate, and land uses, including multiple off-highway recreational attractions. Effective weed management requires land management agencies to coordinate their efforts across the affected, and potentially affected, landscape.

Before this project, federal, state, and local agencies in Crook and surrounding counties were independently monitoring and combating the spread of noxious weeds, but a commonly accessible source for noxious weed data did not exist. To remedy this, Station scientists and collaborators established contacts within the

Terry Shaw

Noxious weeds can contaminate agricultural products and sicken livestock. Scientists helped Crook County, Oregon, control the spread by developing maps and models that identify vulnerable areas.

various agencies and mapped the location of the top 15 invasive weeds. Models that project the probable expansion of the weeds were also developed and validated, enabling land managers to focus weed management efforts in areas where spread is most likely.

Contact: Charles (Terry) Shaw, cgshaw@fs.fed.us, Western Wildlands Environmental Threat Assessment Center

Partners: Crook County, Oregon Geographic Information Systems Office

Outcome: Study helps coordinate noxious weed management in Crook County.

National Environmental Policy Act process on way to becoming more efficient

Administering the National Environmental Policy Act (NEPA) is one of the most demanding and publicly visible functions of the Forest Service. As part of the NEPA for the 21st Century Initiative, nine studies examined how the NEPA process could be administered more efficiently within the agency. Some findings from these studies indicate that (1) passionate leaders who encourage stakeholder participation are common elements of success, (2) there is more within-region variation than between-region variation in NEPA processes, (3) multiple federal agencies value having a dedicated interdisciplinary team and a staff writer, and (4) certain activities would be amenable to outsourcing.

Regional planning staff, line officers, and national-level NEPA program staff helped develop the initial research questions addressed in the nine studies to ensure that the findings and resulting recommendations would meet the information needs of on-the-ground NEPA practitioners. Elements of these studies are being used by National Forest System staff to consider alternative organizational structures and management processes for conducting NEPA activities.

Contact: David Seesholtz, dseesholtz@fs.fed.us, Focused Science Delivery Program

Partners: USDA Forest Service Ecosystem Management Coordination, Washington office; Virginia Tech University; State University of New York at Buffalo; University of California at Berkeley; Indiana University; Oregon State University; Society of American Foresters

Outcome: National Forest System is considering alternative processes for administering NEPA more efficiently.

NEW TOOL

Stand Visualization Add-in for Excel™

Description: This is a user-friendly interface program for the Stand Visualization System (SVS). It streamlines the process of creating forest images to depict dwarf mistletoe infections in live trees and a range of mortality structures including uprooted, broken, or standing dead trees.

Outcomes: Stand images that can be used to illustrate or communicate forest health scenarios or management treatment scenarios.

How to get it: Visit http://silvae.cfr.washington.edu/stnadviz-addin/

Continue to Part 3